SD11
A5A2
1929

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

FOREST SERVICE
SOUTHWESTERN FOREST EXP. STA
FLAGSTAFF, ARIZONA
FEB 17 1930
RECEIVED

FEB 11

STATEMENT FOR THE FOREST RESEARCH COUNCIL

Concerning the Work of the
Pacific Northwest Forest Experiment Station
for the Year 1929, and Plans for 1930

Contents

General	2
Personnel	3
Affiliation with Bureau of Entomology	4
Experimental and Demonstration Forests	4
Research Reserves	4
Forest Research Notes	4
List of Publications and Major Reports	5
Allotments and Expenditures	6
Principal Active Projects in 1929	6
Economic Studies	6
Planting Studies	7
Natural Reproduction	8
Methods of Cutting in Western Yellow Pine	9
Slash Disposal	10
Mensuration	11
Fire Studies	12
Botanical Studies	14
Program of Work in 1930	15
Additional Important Studies	16

General

The Forest Experiment Station is each year fulfilling a larger and larger service in its region, judging by requests for its services and the character and number of its contacts. The results of its studies give the basic facts upon which progress in forestry, both economic and silvicultural, must be built. The staff is able to be a material aid to allied agencies and the general public as a source of technical information on forest matters.

Unfortunately the results of forest research are inevitably slow in coming, due to the long life cycle of trees and the exceeding complicity of the factors that affect forest phenomena, such as growth and yield, forest fire behavior, or reproductive processes. Most of the projects on the program must be conducted three, five, or even more years before conclusions can be reached. From now on an increasing number of projects will begin to yield final conclusions or at least useful preliminary findings.

The outstanding new activity of the year is the initiation of the Forest Survey of the Douglas fir region. This project has already doubled both the allotment and the staff of the Station. Its status is covered later in this statement, and the digest of its plan of work is embodied in a separate memorandum.

The facilities of the staff, such as instrumental equipment and library, have been expanded normally in a small way. Some 367 photographs have been added to the collection this year.

The cooperative relationships between the staff and many other agencies have been most pleasant. A number of agencies have directly contributed to the carrying on of certain of the Station's projects, such as the Oregon State College, the City of Seattle, and the National Park Service in the phenological study; the University of Washington, Oregon State College, and Washington State College in the yellow pine heredity study; the Bureau of Plant Industry in the Douglas fir slash disposal study; the State Forester and the County Fire Wardens in the forest survey. These are but some of the agencies and individuals who have either directly or indirectly aided in the staff's activities, to all of whom credit is due.

The Station has extended its services to many agencies, both public and private, to further their activities which are in line with the Station's own objectives, notable among which this year are:

Cooperation with the Eddy Tree Breeding Station in tests of yellow pine species.

Assistance on the study of radio communication on the national forests.

Contributions for the "Cooperative study of the Gray's Harbor Area" of the Western Forestry and Conservation Association.

Statistical information compiled for the Portland Chamber of Commerce and similar agencies.

Cooperation with the Long Bell Lumber Company in its study of selective logging.

Advice to the District Forester as to silvicultural practices for specific large timber sales on the national forests.

As heretofore the Station collaborated actively with the Office of Products of the North Pacific District, with the District Forester in Alaska, the Bureau of Entomology, the Bureau of Plant Industry, the Weather Bureau, and the British Columbia Forest Service.

Personnel of the Station

There have been no changes in the technical personnel during the year except the addition of five new men for the Forest Resource Survey. Mr. McArdle was on duty only during the summer, having been granted furlough again this year to take postgraduate study at the University of Michigan to fit himself for forest fire research. Mr. Meyer returned from furlough July 1, having concluded his studies and received the degree of Doctor of Philosophy at Yale. The year-long force now consists of the following:

Name	Title	Field of Work
T. T. Munger	Principal Forest Economist	Director
W. H. Meyer	Associate Silviculturist	Mensuration
R. E. McArdle	Assistant Silviculturist	Fire Studies
L. A. Isaac	Assistant Silviculturist	Silviculture in Douglas fir region
E. L. Kolbe	Junior Forester	Silviculture in yellow pine region
A. G. Simson	Scientific Aid	Fire studies and resident officer at Wind River Branch
H. J. Andrews	Senior Forest Economist	In charge Forest Resource Survey
R. W. Cowlin	Associate Forest Economist	Forest Survey
D. N. Matthews	Assistant Forester	Forest Survey on the National Forests
F. L. Moravets	Junior Forester	Forest Survey
P. A. Briegleb	Junior Forester	Forest Survey
June H. Wertz	Senior Clerk	Chief Clerk
Edith A. Parmeter	Junior Clerk	Stenographer

In addition temporary field assistants are employed in the summer and temporary computers in the winter.

Affiliation with Bureau of Entomology

This past fall the Bureau of Entomology established a forest insect field station in Portland to cover the states of Oregon and Washington, hitherto covered by their field station at Palo Alto, California and Coeur d'Alene, Idaho. It is the function of the office to conduct research in forest insects and to advise as to the control of forest insect pests. This new field station is in charge of F. P. Keen who is assisted by J. A. Beal. Their office is located adjoining the Experiment Station office in the Lewis Building, which makes possible close cooperation and joint use of facilities.

Experimental and Demonstration Forests

Realizing the desirability of concentrating forest research on specific tracts set apart primarily for that purpose, a special effort has been made this past year to find areas on the national forests that are suitable for this purpose. Experimental forests are notably successful in Europe and in the East, both as experimental ground and for demonstration purposes. The Station is now concentrating as much of its work as possible at certain centers, but only at Wind River, Washington is there a definite set-up looking toward an experimental-demonstration forest. The search for suitable tracts that can be set apart primarily for experimental use will be continued in the Douglas fir type, in the spruce-hemlock type of the fog belt, and in the pine region.

Research Reserves

A recent regulation of the Forest Service provides for setting apart areas of several hundred acres each, typical of the principal forest types, for preservation in their absolutely natural virgin condition for scientific study and comparison. A number of areas were examined last year with this in view, but so far only one tract (at Wind River, Washington) has been definitely set apart as a virgin timber research reserve. Several others have been recommended by local forest officers and tentatively approved for reservation.

Forest Research Notes

Two issues of Forest Research Notes (mimeographed) were sent to a selected mailing list of about 300. Each issue gave in concise form the progress results of four or five technical studies.

List of Publications and Major Manuscript Reports Prepared in 1929

Thornton T. Munger	National Forest Resource Survey, Timberman, December 1929
Thornton T. Munger in cooperation with A. G. Simson	Snag Falling - Timberman, April 1929
Thornton T. Munger in cooperation with R. H. Westveld	Slash Disposal in the Western Yellow Pine Forests of Oregon and Washington (Submitted for publication as U. S. Department of Agriculture Circular)
R. E. McArdle	A Summary of Observations Made of the Shriner Lake Fire, Rainier National Forest, August 7 - 9, 1929 Ms report. Analysis of Forest Fire Reports for Grays Harbor County, Washington (Chapter in Cooperative Forest Study of the Grays Harbor Area)
R. E. McArdle in cooperation with W. H. Meyer	The Yield of Douglas Fir Forests in the Pacific Northwest (U. S. Dept. Agri. Technical Bulletin now in the press)
W. H. Meyer	A Study of the Relation Between Actual and Normal Yield of Immature Douglas Fir Forests. (Article submitted to the Journal of Agricultural Research) Diameter Distribution Series in even-aged forest stands (Dissertation prepared while on furlough)
L. A. Isaac	A Measure of Seed Fall under Timber and on Adjacent Cut-over Lands in the Douglas Fir Region. Ms report. Measurement of Seed Flight in the Douglas Fir Region (Submitted for publication in Journal of Forestry) Reproduction in the Fog Belt (Chapter in Cooperative Forest Study of the Grays Harbor Area)
A. G. Simson	Experimental Methods of Snag Falling in the Douglas Fir Region. Ms report. Lightning and Fires. Four L Lumber News, June 1929

Allotments and Expenditures

The allotments to the Pacific Northwest Forest Experiment Station for the fiscal year 1930 (July 1, 1929 to June 30, 1930) are

Silvical Investigations	$28,920
Forest Survey	30,000
Equipment and Supplies	300
Improvement	100
Total - - - - - - - - -	$59,320

During the fiscal year 1929, expenditures for the major lines of work were as follows:

Management (Methods of Cutting, Natural Reproduction, and Slash Disposal)	$16,645.00
Mensuration	5,777.00
Fire Studies	5,155.00
Forestation	1,963.00
Total - - - - - - - - -	$29,540.00

PRINCIPAL ACTIVE PROJECTS IN 1929

Economic Studies

Two economic studies, both nation wide in scope, are being launched this winter in the Douglas fir region of the Pacific Northwest, namely, the Forest Survey and the Forest Insurance studies.

Forest Survey

This project, authorized by the McSweeney-McNary Act, involves (1) an inventory of the present forest resources of the country, (2) the rate of actual and potential growth on all forest lands, (3) the rate of depletion from all causes, (4) the national requirements for forest products. This Station was given $30,000 for the current year to commence the study. It is estimated that the Douglas fir region of twenty-five million acres will require at least $150,000 to make the survey according to the standards which have been set. A staff is being very carefully chosen, and much thought devoted to drawing up the plans. So far work has been done only upon the inventory phase of the study. Washington County, Oregon was chosen as a sample area to work through to completion to test out the technic. Compilation of the timber estimates and cover types for this

county is well along and considerable data outside the county have also been obtained. The sources of information for Oregon have already been canvassed systematically. It is expected that it will take at least two years and a half to complete the project in this region. A digest of the working plan for this study is submitted under separate cover as a basis for discussion.

Forest Insurance

A study of forest insurance was authorized by the Clark-McNary Act and has been begun within the last three months. H. B. Shepard, a forester with several years experience in insurance, has been engaged for this study. After completing a reconnaissance of the subject from a national viewpoint, he, probably with one assistant, will conduct as an activity of this Station an intensive study of the practicability and technic of insuring both old-growth and immature forests in the Douglas fir region.

Planting Studies

Regional Races of Western Yellow Pine

The total number of trees set out on the six plantations established in 1928 was increased to over 32,000 by the addition this past spring of two new lots. This completes the series of races of yellow pine, from various parts of its natural range that are to be tested for hereditary traits and differences in vigor. The table below gives the survival in per cent for the various plots. The Oregon State College plantation was considerably damaged by rodents the past year, which accounts for the low survival of seedlings. The data for the Washington State plot are for the year ending 1928. All the others are for 1929. The first two lots of trees listed were planted a year later than the other eight.

Source of Seed	Pack Forest	Columbia Forest	Wash. State College	Deschutes Forest	Whitman Forest	Oregon State College	Average Omitting O.S.C.
Western Washington	85	95	--	66	88	--	83
Western Oregon	81	100	--	73	69	--	83
Central Oregon	99	92	93	74	56	30	80
Northern California	96	96	77	68	27	18	78
Southwestern Montana	80	95	40	36	51	28	68
Northern New Mexico	89	72	52	53	34	10	66
Southern Oregon	98	95	96	46	26	24	65
Central California	89	83	51	68	19	35	63
Central Arizona	94	76	61	42	11	19	62
Black Hills, S. Dak.	98	63	74	33	29	6	56
Average	90	86	64	54	39	21	70

Douglas Fir Heredity Study

These plantations did not come up for examination this year, but a progress report is in preparation. Ten sets of periodic measurements for the five plantations, comprising over 180,000 observations, have been organized for analysis. This experiment was started in 1913 when seed from 123 different trees, representing about 25 types of parentage, was sown in the nursery and later planted on several forests. It is now commonly recognized that the success of a planting project is dependent to a considerable extent on the source of seed. What is the best source of seed is the problem.

Tests of Species at Wind River Arboretum

The Wind River Arboretum was augmented by the addition of 53 new lots of seed or trees, making a total of 400 lots tested to date. The entire plantation of exotic trees was given its five-year periodic examination tree by tree, but the results have not yet been written up for publication. They show rather convincingly which species are adapted to that climate and which are not, and their relative thrift and growth rate. There was some exchange of surplus seed or trees with other experimenters, both local and foreign.

Nursery and Planting Technic (Conducted chiefly by the District Forester's Organization)

Studies under way have been continued on seed storage and nursery practice, special attention being given to developing seedling stock satisfactory for outplanting, thereby omitting the expensive step of transplanting in the nursery. In addition special studies were conducted on "damping-off" control and heat injury to seedlings in cooperation with the Bureau of Plant Industry. In the field, tests of species, methods and spacing are being followed, and the 1928 direct seeding tests with the small seeded species of the fog belt were duplicated in an effort to check differences in survival during different seasons and under various degrees of cover development. Abundant germination was found in June on areas seeded the previous year.

Natural Reproduction

Reproduction Habits of Douglas Fir

The comprehensive study of the natural reproduction of Douglas fir and its associates under way during 1928 was continued through 1929. The principal phases of this study listed in the order of importance are:

a. Instrumental measurement of physical factors to determine the cause of seedling losses
b. Natural germination and survival observed on 20 areas (total of 300 sample plots) representing various sites and ground conditions on logged-off lands in different parts of the region
c. Influence of sheep grazing on seedling survival and reduction of fire hazard
d. Season and distance of seed dissemination
e. History of seed after it falls
f. The survival and effectiveness of seed trees

These studies are all of a long-time nature and are as yet far from complete, but each of them has already yielded valuable information. They have brought out the startling fact that four-fifths or more of the annual seedling crop is lost on cut-over areas during the first ten years after logging, and indicate that high surface soil temperature, made higher (average 17°) by blackening the soil surface through burning, is the chief cause of loss. Seed dissemination studies indicate that normal effective seeding distances are under a quarter mile. The studies as a whole show definitely that unavoidably high losses of seed and seedlings coupled with infrequent (3 to 5 years) heavy seed crops, recurring fires, and rapidly retreating forest edges, make necessary either a more adequate and lasting source of seed, or artificial reforestation, if logged-off lands are to be kept forest covered.

These studies should be continued, aiming toward the discovery of means to reduce the seedling loss and to secure more adequate natural seeding of logged land; they should be extended from the fir region to the fog belt.

Methods of Cutting in Western Yellow Pine

The area in plots for this project now totals 242.8 acres, on which are some 5500 tagged trees 4 inches and over in diameter. The plots, of which there are 17, were so treated as to get a sample of various methods of cuttings which may have practical application and give a better understanding of both financial and silvicultural considerations. Several plots were marked on an age basis, that is, only a certain age class was cut. In other plots vigor, crown development, size and quality of bole, or a combination of these factors was used for the criterion. For example, on one 10-acre plot all trees 14 inches and over in diameter were cut, while in a similar plot near by only the trees with the highest quality material up to 50 per cent of the total volume were removed. The board foot volume reserved on the 17 plots ranges from 5 to over 50 per cent.

This past year one new 10-acre plot was established on the Deschutes Forest to complete the series of tests in that locality. All the

plots were given at least one examination during the year, and those upon which the subsequent reproduction was being watched closely were given three.

On three plots on the Whitman National Forest there are now 15 annual records on growth and survival. These data are at present being organized for analysis and publication. It is of interest that during the first five years the mortality of subsequent seedlings on Plot A ranged from about 40 to 90 per cent of the total germination. Here there were 1696 subsequent seedlings per acre in 1919, 1208 in 1924, and 1280 in 1929--not a very encouraging evidence of the vigor of subsequent seedlings in this pine region, even with a heavy reserve stand. The method of cutting on this plot was a light selection in which about 35 per cent of the total volume was reserved.

Slash Disposal

Slash Disposal in Western Oregon and Washington

Because of McArdle being on furlough except during the summer and spending most of his time on going fires, only a few weeks work was done on this project this year. The proper disposal of slash in each type of country and timber in the Douglas fir region continues to be a most important technical problem. The remaining fuels on 17 of the last year's plots were remeasured after burning to get a quantitative expression of what the slash fire actually did. Five new plots were established, making a total of 46, representing a wide variety of conditions, under observation.

The opportunity to study instrumentally actual fires running in slash gave additional information of significance. For example, with fuels at a moisture content of about 11 per cent, and relative humidity at not under 49 per cent, a fire spread 3000 lineal feet per hour with a wind of 6 miles per hour (not including spot fires), 75 feet per hour with no wind, and 10 feet per hour against a 6-mile wind. With fuel conditions favorable to ignition, wind was proven to be the dominating factor influencing the controllability of this fire in fresh slash.

Slash Disposal in Pine Forests

Though field work on this project was concluded more than a year ago, except for some follow up on permanent plots, considerable office work was done this year in putting the long and detailed project report in shape for publication as a Department of Agriculture circular, which it is hoped may be issued before long.

Mensuration

Growth of Douglas Fir Stands Studied by Means of Permanent Sample Plots

During the year four new plots were established for the detailed study of development and growth of young stands. One plot was in a 19-year-old plantation, and the other three in a 27-year-old stand near Wind River which originated after the Yacolt fire of 1902. This brings the number of such plots that are maintained under this project, up to 36; 7 of the older plots came up for remeasurement this year. This study is giving most conclusive information as to the actual productivity of western Oregon and western Washington forest soils, and as to the life cycle of Douglas fir forests.

The bulletin by McArdle on the normal yield of immature Douglas fir stands has gone through another revision and a chapter on the application of normal yield tables to actual stands by Meyer has been added; it will soon be available for distribution.

Yield of Western Yellow Pine in Eastern Oregon and Washington

Field work on this project was resumed late in the spring upon the return of Meyer from furlough. A crew of three spent three months measuring and describing plots, and by means of increment borings recording the growth of individual trees which had been reserved after sundry types of selection cutting in various parts of eastern Oregon. To date a total of 4000 trees and 134 sample plots have been so studied and will now be analyzed.

In addition to the study of the growth of selectively cut stands, 52 even-aged immature stands have been sampled. It is the intention to study additional stands, both selectively cut uneven-aged stands and even-aged immature stands in both States.

The office work in connection with this project is enormous but has reached a point where tentative results are available for immediate use. The following preliminary table has just been completed and is presented for the interest that it may have. It is subject to correction after being checked with more data yet to be collected or computed.

A preliminary yield table for selectively cut stands of western yellow pine Site IV; central and eastern Oregon

Initial reserve volume in bd.ft. Scribner rule	Number of years after cutting					
	10	20	30	40	50	60
	bd. ft. volume attained.					
1000	1350	2300	3250	4200	5100	6000
2000	2400	3350	4300	5250	6150	7100
3000	3550	4500	5450	6400	7300	8200
4000	4550	5550	6500	7450	8400	9300
5000	5700	6700	7600	8600	9500	10550
6000	6800	7800	8700	9700	10700	11800

Mortality is not allowed for in this table since information at hand is still inconclusive. Indications lead to the belief that the loss in selectively cut stands averages about 0.15 per cent of the original volume per year for the first 15 or 20 years after cutting.

Fire Studies

Behavior of Going Fires

A number of going fires were studied intensively during the past season and a distinct addition was made to the knowledge of the role of the many physical factors that govern fire behavior. In August six fires were studied. On the Shriner Lake Fire, Rainier National Forest, continuous records of fire behavior, relative humidity, wind velocity, and fuel moisture content were obtained on a quarter-mile wide front for 67 hours. This fire offered unusual opportunity for study before, during, and after a "blow-up". It was in a 40-year-old burn with many standing snags and a fairly thick cover of young trees 20-30 feet tall. It was found that while the fuels were exceedingly dry at all times, they fluctuated with changes in relative humidity. The "lag" of fuel moisture behind humidity was about 2 hours for the snags and logs and somewhat longer for branch wood and rotten wood. Wind was always found to be an exceedingly important factor, both as to velocity and direction, and in at least one instance was the most important factor governing fire spread. This emphasizes the importance of a thorough knowledge of mountain and valley breezes in laying fire suppression plans.

A series of experiments was made last summer to learn whether or not certain alkali metals in solution, highly recommended as fire extinguishers, were more efficient than water in extinguishing fires in forest slash. Aqueous solutions of potassium dichromate, potassium chloride, potassium nitrate, potassium carbonate and sodium acetate were used. The test fires

were composed of 13 cubic feet (100 pounds) of branch wood and twigs from month-old Douglas fir-hemlock slash. The solutions were applied with a Forest Service back pack pump. The averaged results showed that to extinguish a test fire with water required 4.6 gallons and to extinguish one with a chemical solution required 4.1 gallons, but with no one solution showing outstanding superiority over water. The advantage of the slight saving in water was more than overbalanced by the disadvantages of added weight and cost of the chemicals, at least so far as this kind of fuels is concerned.

Weather and Fuel Relationships

Investigations into the meteorological influences which affect forest fuel inflammability have been in progress at the Wind River Branch for several years. Changes in inflammability as evidenced by fuel moisture content have been studied both as to seasonal march and diurnal fluctuations. Data on the seasonal march consist of moisture content measurements of fern, fireweed, Douglas fir needles, duff under mature forest and duff under 25-year-old Douglas fir reproduction made at 10-day intervals throughout the fire season.

One hundred hourly measurements of the moisture content of .21 forest fuels were correlated with atmospheric relative humidity data and have furnished interesting information on the effect of relative humidity on the daily variations in fuel moisture. For example, it was found that variations in the moisture content of bracken fern follow changes in relative humidity but with a time lag of about one hour, and that about 75 per cent of the variability of the fern moisture is associated with variations in humidity. The outside 1/8 inch layer of Douglas fir snags was about 20 minutes slower than the fern in responding to humidity changes, while Douglas fir twigs lagged as much as two hours. Information obtained in these studies, coupled with humidity records under various cover types and at several altitudes, will be of assistance in estimating the duration and degree of fire hazard on given areas. All of which is a necessary factor in hazard rating and very important both in presuppression and fire-fighting tactics. Simultaneous records of humidity in slashings, under Douglas fir reproduction and at high altitudes are being made for comparison with humidity records at the Wind River Branch as contributory evidence in the study of relative hazard.

The interception of summer rains by forest cover is being studied. The interception is evaluated by comparing precipitation measurements at a dozen or more points under a dense stand of Douglas fir reproduction with check measurements made in the open. Few data were obtained last year because of the small number of summer showers.

Reporting and Charting Lightning Storms

Lightning continues to be a major item in the list of fire-starting agencies. There being little chance of preventing lightning, the first line of defense lies in being able to anticipate when and where the storm is most likely to occur. The information on lightning storm characteristics comes from detailed reports furnished by the lookouts on the national forests. Beginning in 1924 and including 1929, a total of 4,765 lightning storm reports have been received from the lookouts of Oregon and Washington. From these reports the tracks of the individual storms have been plotted on forest maps. The contents of the current reports have been tabulated for use in a nation-wide statistical "punch-card" analysis of thunderstorms and their characteristics. The year-to-year variations, both in number and location of lightning storms, makes it necessary to continue this study over a longer period of years in order to obtain a true picture of lightning storm occurrence and behavior on the national forests.

Static as an Indicator of Fire Weather

The local prediction of thunderstorms is likewise coming in for attention. The predictions are based on observations and records of atmospheric static. Predictions of whether or not thunderstorms would occur on the Columbia National Forest were made each morning from May 21 to September 21 inclusive. Thunderstorms were twice predicted (July 30 and 31) for the Mt. Adams Ranger District of the Columbia Forest. In both instances the storms did not strike the Mt. Adams District but did occur a few miles outside the boundary. No thunderstorms occurred on the Columbia Forest during the entire season.

Advices of static behavior were given to the Mt. Hood Forest but no regular daily predictions were issued. The advices contained information as to the intensity of the static and the apparent direction from which it was coming. The fire dispatcher on that forest asserts the information was valuable and was used to good advantage.

A small static-indicating instrument was assembled with the idea that it might be useful to the dispatchers in estimating the chances of local thunderstorms. Lack of local storms prevented checking up on the behavior of this instrument under thunderstorm conditions. It is planned to install the indicator in the dispatcher's office of some forest, probably the Mt. Hood.

Botanical Studies

Phenology

For three years observations have been made at 21 stations in the Douglas fir region of the time that forest trees and their associated plants

vegetate, bloom, and ripen fruits. These stations are located on each of the west side national forests, at Seattle's Cedar River Nursery, and at the Peavy Arboretum. These phenological data have been transferred in the office to cumulative record cards. In another two years it is expected that there will be sufficient material to warrant a report on the habits of the more important indicator plants in relation to climate and environment. This will have very practical value in ascertaining comparatively the length of the growing period of trees at various places, the earliness or lateness of the season, the status of the fire season so far as condition of the vegetation is concerned, grazing range readiness, time for seed collecting, etc. This year's progress report considers field technic and quality of work primarily and lists only a few preliminary findings.

PROGRAM OF WORK FOR 1930

Practically all the projects on the past year's program are still uncompleted and should be continued to conclusion. Some of them are projects that must last many years, for example, through the life cycle of the plantation or through the cutting cycle of the stand. It is recommended, therefore, that the following projects compose the program for 1930.

Economic Studies

Forest Survey of the Douglas fir region.
Forest Insurance in the Douglas fir region.

Planting Studies

Regional races of western yellow pine.
Douglas fir heredity.
Tests of species at Wind River Arboretum.
Nursery and planting technic.

Natural Reproduction

Reproduction habits of Douglas fir.
Methods of cutting as they affect reforestation in western yellow pine region.

Slash Disposal

Slash disposal in western Oregon and Washington.

Mensuration

Yield of western yellow pine in eastern Oregon and Washington.
Growth of Douglas fir stands studied by means of permanent sample plots.

Fire Studies

Reporting and charting of lightning storms.
Fire behavior.
Weather and fuel relationship.
Static as an indication of fire weather.

Botanical Studies

Phenological observations.

These projects will so completely obligate the present allotment that no new projects can be begun until some of these current projects are concluded or until there is a larger allotment to the Station for silvicultural investigations.

Additional Important Studies

There are many problems in the field of silvicultural investigations, where study would be of immediate practical value, that should be undertaken as soon as the Station or any of its cooperating agencies are able to undertake them. The following are suggested as illustrative of subjects in forest research barely touched in the region, and as possible projects for future programs:

1. Preparation of a yield table for the very important spruce-hemlock pulpwood type of the fog belt.

2. Methods of reproducing naturally after logging the spruce-hemlock type, especially so as to induce a large percentage of the more valuable spruce.

3. Economic and silvicultural aspects of selection or spot logging in the Douglas fir region.

4. The development of logging methods and logging devices that are favorable to reforestation, and at the same time are economically advantageous and favor close utilization.

5. Study of the precise causes of forest fires, especially industrial fires and the human element, with a view to eliminating such causes.

6. Study of silvicultural treatment to get maximum production of some of the species of growing importance, such as red alder, silver fir, and cascara. (There are 60 tree species in this territory and the growth and forestal requirements of only two have been thoroughly studied.)

POOR QUALITY

The following pages are scanned at the best possible quality setting. The original pages are of poor quality and this is the best possible reproduction.

7. Development of a sc. ific basis for rating fire hazard, for purposes of insurance, allocation of protective effort, developing means to reduce hazards, etc.

8. Improving technic and equipment for detection, communication and suppression of forest fires.

9. Forestry methods for farm woodlots, both in the dry and humid region.